

## WHAT IS CLAIMED IS:

1. A method of designing a magnetic structure for providing a monotonic static magnetic field for magnetic resonance analysis, the method comprising:
  - selecting a first geometry defining a volume-of-interest;
  - selecting a magnetic field query, defined on a plurality of coordinates within said first geometry, said magnetic field query being monotonic;
  - selecting a second geometry defining the magnetic structure; and
  - calculating a remanence distribution within said second geometry by using said first geometry, said second geometry and said magnetic field query, thereby designing the magnetic structure.
2. The method of claim 1, further comprising optimizing the monotonic static magnetic field, by repeating said selecting said first and second geometries and said magnetic field query and repeating said calculating of said remanence distribution.
3. The method of claim 1, wherein said first geometry is selected so that a maximal value of at least one component of said magnetic field query is above a predetermined threshold.
4. The method of claim 3, wherein said predetermined threshold is selected so as to optimize a signal-to-noise ratio and a signal to contrast.
5. The method of claim 1, wherein said second geometry is selected so that a maximal value of at least one component of said magnetic field query is above a predetermined threshold.
6. The method of claim 5, wherein said predetermined threshold is selected so as to optimize a signal-to-noise ratio and a signal to contrast.
7. The method of claim 1, wherein said remanence distribution is calculated by constructing a functional of said remanence distribution and minimizing

said functional using a set of constraints.

8. The method of claim 1, wherein said remanence distribution is calculated by constructing a functional of said remanence distribution and maximizing said functional using a set of constraints.

9. The method of claim 7, wherein each constraint of said set of constraints is selected from the group consisting of an equality constraint and an inequality constraint.

10. The method of claim 7, wherein said set of constraints are selected so as to optimize the monotonic static magnetic field.

11. A magnetic structure for magnetic resonance analysis, the magnetic structure comprising a plurality of domains, arranged within a volume having predetermined geometry, each of said plurality of domains being characterized by a predetermined and different magnetization vector;

wherein said predetermined geometry and said plurality of domains are selected so as to generate a monotonic static magnetic field having a gradient.

12. The magnetic structure of claim 11, wherein said plurality of domains comprises at least three domains.

13. The magnetic structure of claim 11, wherein said plurality of domains comprises at least four domains.

14. The magnetic structure of claim 11, wherein said predetermined geometry is selected from the group consisting of a cylinder, a disk, a prism, a sphere, a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.

15. The magnetic structure of claim 11, wherein said predetermined

geometry is elongated with respect to a longitudinal axis, and further wherein a size of the magnetic structure is selected so as to allow the magnetic structure to be inserted into a body of a subject by endoscopy.

16. The magnetic structure of claim 15, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed perpendicular to said longitudinal axis so that said monotonic static magnetic field is also in a direction perpendicular to said longitudinal axis.

17. The magnetic structure of claim 15, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed parallel to said longitudinal axis so that said monotonic static magnetic field is also in a direction parallel to said longitudinal axis.

18. The magnetic structure of claim 15, further comprising at least one additional magnetic structure designed connectable to the magnetic structure, wherein said at least one additional magnetic structure capable of generating a monotonic static magnetic field.

19. The magnetic structure of claim 18, wherein said at least one additional magnetic structure operable to rotate about a transverse axis by one of a plurality of predetermined angles.

20. The magnetic structure of claim 15, wherein said monotonic static magnetic field varies along said longitudinal axis.

21. The magnetic structure of claim 15, wherein said magnetization vectors vary along a radial direction, said radial direction being perpendicular to said longitudinal axis.

22. The magnetic structure of claim 15, wherein said magnetization vectors vary along an azimuthal direction, said azimuthal direction being perpendicular to said

longitudinal axis.

23. The magnetic structure of claim 11, further comprising at least one non-magnetic domain located so as to optimize a profile of said monotonic static magnetic field.

24. The magnetic structure of claim 23, designed connectable to a radiofrequency antenna and further wherein said at least one non-magnetic domain is constructed and designed for minimizing a load on said radiofrequency antenna and for minimizing magnetic acoustic ringing.

25. The magnetic structure of claim 23, wherein a size of said at least one non-magnetic domain is selected so as to be surrounded by at least one radiofrequency coil.

26. The magnetic structure of claim 23, wherein a size of said at least one non-magnetic domain is selected so as to minimize an amount of magnetic material present in the magnetic structure.

27. The magnetic structure of claim 23, wherein said at least one radiofrequency coil comprises a soft magnetic material.

28. The magnetic structure of claim 11, wherein said predetermined geometry is characterized by at least one substantially planar surface, said at least one substantially planar surface defined by an axis being perpendicularly to said at least one substantially planar surface.

29. The magnetic structure of claim 28, wherein said plurality of domains are concentrically arranged about a center of the magnetic structure, and further wherein a magnetization vector of each domain has a component directed along said axis, so that said monotonic static magnetic field is also directed along said axis.

30. The magnetic structure of claim 11, wherein said predetermined geometry is characterized by a planar surface and a non-planar surface, said non-planar surface having a first open end, adjacent to said planar surface, and a second open end, far from said planar surface, where an area of said first open end is smaller than an area of said second open end.

31. The magnetic structure of claim 30, wherein said plurality of domains are arranged within said non-planar surface, and further wherein a magnetization vector of each domain has a component directed substantially parallel to said planar surface, so that said monotonic static magnetic field is also directed substantially parallel to said planar surface.

32. The magnetic structure of claim 11, wherein said predetermined geometry is a shell having a cavity and a symmetry axis, said shell is selected from the group consisting of a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.

33. The magnetic structure of claim 32, wherein a magnetization vector of each domain is directed along said symmetry axis so that said monotonic static magnetic field is also directed along said symmetry axis.

34. The magnetic structure of claim 32, wherein a magnetization vector of each domain is directed perpendicularly to said symmetry axis so that said monotonic static magnetic field is also directed perpendicularly to said symmetry axis.

35. An apparatus for magnetic resonance analysis, the apparatus comprising:

a processing unit;

a radiofrequency coil designed and configured for generating a broad-band radiofrequency magnetic field; and

a magnetic structure for generating a monotonic static magnetic field having a

gradient, said magnetic structure comprising a plurality of domains, said plurality of domains being arranged within a volume having predetermined geometry, each of said plurality of domains being characterized by a predetermined and different magnetization vector, wherein said predetermined geometry and said plurality of domains are selected so as to generate said monotonic static magnetic field.

36. The apparatus of claim 35, further comprising a first gradient coil for generating a magnetic field having a gradient substantially in a first transverse direction.

37. The apparatus of claim 36, further comprising a second gradient coil for generating a magnetic field having a gradient substantially in a second transverse direction.

38. The apparatus of claim 36, wherein said first gradient coil is positioned on a surface of said magnetic structure.

39. The apparatus of claim 37, wherein said first and said second gradient coils are positioned on a surface of said magnetic structure.

40. The apparatus of claim 37, wherein said first and said second gradient coils are arranged in one layer.

41. The apparatus of claim 37, wherein said first and said second gradient coils are arranged separate layers.

42. The apparatus of claim 36, wherein said radiofrequency coil is positioned on a surface of said magnetic structure and further wherein said first gradient coil and said radiofrequency coil are arranged in one layer.

43. The apparatus of claim 37, wherein said radiofrequency coil is positioned on a surface of said magnetic structure and further wherein said first gradient coil and said radiofrequency coil are arranged in one layer.

44. The apparatus of claim 36, wherein said magnetic structure is detachable.

45. The apparatus of claim 36, wherein said magnetic structure is replaceable.

46. The apparatus of claim 36, wherein said magnetic structure comprises at least two parts, each independently operable to rotate about a longitudinal axis.

47. The apparatus of claim 36, wherein said magnetic structure comprises at least two parts, each independently operable to move along a longitudinal axis.

48. The apparatus of claim 35, wherein said plurality of domains comprises at least three domains.

49. The apparatus of claim 35, wherein said plurality of domains comprises at least four domains.

50. The apparatus of claim 35, wherein said predetermined geometry is selected from the group consisting of a cylinder, a disk, a prism, a sphere, a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.

51. The apparatus of claim 35, wherein said predetermined geometry is elongated with respect to a longitudinal axis, and further wherein a size of said magnetic structure is selected so as to allow said magnetic structure to be inserted into a body of a subject by endoscopy.

52. The apparatus of claim 51, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed perpendicular to said longitudinal axis so that

said monotonic static magnetic field is also in a direction perpendicular to said longitudinal axis.

53. The apparatus of claim 51, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed parallel to said longitudinal axis so that said monotonic static magnetic field is also in a direction parallel to said longitudinal axis.

54. The apparatus of claim 51, further comprising at least one additional magnetic structure designed connectable to said magnetic structure, wherein said at least one additional magnetic structure capable of generating a monotonic static magnetic field.

55. The apparatus of claim 54, wherein said at least one additional magnetic structure operable to rotate about a transverse axis by one of a plurality of predetermined angles.

56. The apparatus of claim 51, wherein said monotonic static magnetic field varies along said longitudinal axis.

57. The apparatus of claim 51, wherein said magnetization vectors vary along a radial direction, said radial direction being perpendicular to said longitudinal axis.

58. The apparatus of claim 51, wherein said magnetization vectors vary along an azimuthal direction, said azimuthal direction being perpendicular to said longitudinal axis.

59. The apparatus of claim 35, said magnetic structure further comprising at least one non-magnetic domain located so as to optimize a profile of said monotonic static magnetic field.

60. The apparatus of claim 59, wherein said radiofrequency coil comprises



a radiofrequency antenna and further wherein said at least one non-magnetic domain is constructed and designed for minimizing a load on said radiofrequency antenna and for minimizing magnetic acoustic ringing.

61. The apparatus of claim 59, wherein a size of said at least one non-magnetic domain is selected so as to be surrounded by at least one radiofrequency coil.

62. The apparatus of claim 59, wherein a size of said at least one non-magnetic domain is selected so as to minimize an amount of magnetic material present in said magnetic structure.

63. The apparatus of claim 59, wherein said at least one radiofrequency coil comprises a soft magnetic material.

64. The apparatus of claim 35, wherein said predetermined geometry is characterized by at least one substantially planar surface, said at least one substantially planar surface defined by an axis being perpendicularly to said at least one substantially planar surface.

65. The apparatus of claim 64, wherein said plurality of domains are concentrically arranged about a center of said magnetic structure, and further wherein a magnetization vector of each domain has a component directed along said axis, so that said monotonic static magnetic field is also directed along said axis.

66. The apparatus of claim 35, wherein said predetermined geometry is characterized by a planar surface and a non-planar surface, said non-planar surface having a first open end, adjacent to said planar surface, and a second open end, far from said planar surface, where an area of said first open end is smaller than an area of said second open end.

67. The apparatus of claim 66, wherein said plurality of domains are arranged within said non-planar surface, and further wherein a magnetization vector of each domain has a component directed substantially parallel to said planar surface, so

that said monotonic static magnetic field is also directed substantially parallel to said planar surface.

68. The apparatus of claim 35, wherein said predetermined geometry is a shell having a cavity and a symmetry axis, said shell is selected from the group consisting of a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.

69. The apparatus of claim 68, wherein a magnetization vector of each domain is directed along said symmetry axis so that said monotonic static magnetic field is also directed along said symmetry axis.

70. The apparatus of claim 68, wherein a magnetization vector of each domain is directed perpendicularly to said symmetry axis so that said monotonic static magnetic field is also directed perpendicularly to said symmetry axis.

71. The apparatus of claim 35, further comprising at least one additional radiofrequency coil for generating a broad-band radiofrequency magnetic field and at least one additional magnetic structure for generating a monotonic static magnetic field having a gradient, wherein each of said at least one additional radiofrequency coil is in proximity to said at least one additional magnetic structure.

72. The apparatus of claim 35, further comprising a power supply and a wireless transmitter for transmitting information from the radiofrequency coil, wherein a size of said radiofrequency coil and a size of said magnetic structure are selected so as to capsule said radiofrequency coil and said magnetic structure into a compact probe to be swallowed by a subject.

73. The apparatus of claim 35, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating

predetermined and different magnetic resonance responses in predetermined and different types of cells.

74. The apparatus of claim 73, wherein said predetermined types of cells are selected from the group consisting of a part of a tumor, a part of a malignant tumor, a part of a blood vessel tissue, a part of a pathological tissue and a part of a restenotic tissue.

75. The apparatus of claim 35, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating a predetermined and different magnetic resonance responses in a first substance and in at least one additional substance present in or surrounded by said first substance, thereby distinguishing between said first substance and said at least one additional substance.

76. The apparatus of claim 35, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating a magnetic resonance response in at least one substance having dynamical resonance characteristics, said dynamical resonance characteristics being time-dependent.

77. The apparatus of claim 76, design and constructed to monitor said dynamical resonance characteristics.

78. A magnetic structure for magnetic resonance analysis, comprising a structure defined according to a remanence distribution, said remanence distribution being determined according to a first geometry for defining a volume-of-interest, a second geometry for defining the magnetic structure, and a magnetic field query being defined on a plurality of coordinates within said first geometry, said magnetic field query being monotonic.

79. The magnetic structure of claim 78, wherein said first geometry is

selected so that a maximal value of at least one component of said magnetic field query is above a predetermined threshold.

80. The magnetic structure of claim 79, wherein said predetermined threshold is selected so as to optimize a signal-to-noise ratio and a signal to contrast.

81. The magnetic structure of claim 78, wherein said second geometry is selected so that a maximal value of at least one component of said magnetic field query is above a predetermined threshold.

82. The magnetic structure of claim 81, wherein said predetermined threshold is selected so as to optimize a signal-to-noise ratio and a signal to contrast.

83. A system for analyzing an object, the system comprising:  
a processing unit;  
a first imaging device; and

a magnetic resonance probe, said magnetic resonance probe comprising a radiofrequency coil, designed and configured for generating a broad-band radiofrequency magnetic field, and a magnetic structure for generating a monotonic static magnetic field having a gradient, said magnetic structure comprising a plurality of domains, said plurality of domains being arranged within a volume having predetermined geometry, each of said plurality of domains being characterized by a predetermined and different magnetization vector, wherein said predetermined geometry and said plurality of domains are selected so as to generate said monotonic static magnetic field.

84. The system of claim 83, wherein the object is an internal object and the system is an invasive system.

85. The system of claim 83, wherein the object is an external object and the system a non-invasive system.

86. The system of claim 83, wherein said first imaging device is an optical

imaging device.

87. The system of claim 86, wherein said optical imaging device is a camera.

88. The system of claim 83, wherein said first imaging device is an ultrasonic imaging device.

89. The system of claim 83, wherein said first imaging device is a nuclear medicine device, being sensitive to radioactive radiation.

90. The system of claim 83, further comprising at least one additional imaging device, said at least one additional imaging device is selected from the group consisting of an optical imaging device, a US imaging device and a nuclear medicine device.

91. The system of claim 83, wherein said first imaging device has a sufficiently wide field-of-view so as to surround at least a portion of said magnetic resonance probe.

92. The system of claim 83, further comprising a communication cable connected to said first imaging device.

93. The system of claim 83, further comprising at least one supporting device for supporting said magnetic resonance probe and said first imaging device.

94. The system of claim 83, further comprising a position tracking system for determining a position of said magnetic resonance probe.

95. The system of claim 94, wherein said position tracking system is selected from the group consisting of an articulated arm position tracking system, an accelerometers based position tracking system, a potentiometers based position tracking system, a sound wave based position tracking system, a radio frequency based

position tracking system, an AC based position tracking system, a magnetic field based position tracking system and an optical based position tracking system.

96. The system of claim 83, wherein a size of said first imaging device and a size of said magnetic resonance probe are selected so as to allow said first imaging device and said magnetic resonance probe to be inserted into a body of a subject by endoscopy.

97. The system of claim 90, wherein a size of said first imaging device, a size of said magnetic resonance probe and sizes of said at least one imaging device are selected so as to allow said first imaging device, said magnetic resonance probe and said at least one imaging device to be inserted into a body of a subject by endoscopy.

98. The system of claim 83, further comprising a first gradient coil for generating a magnetic field having a gradient substantially in a first transverse direction.

99. The system of claim 98, further comprising a second gradient coil for generating a magnetic field having a gradient substantially in a second transverse direction.

100. The system of claim 98, wherein said first gradient coil is positioned on a surface of said magnetic structure.

101. The system of claim 99, wherein said first and said second gradient coils are positioned on a surface of said magnetic structure.

102. The system of claim 99, wherein said first and said second gradient coils are arranged in one layer.

103. The system of claim 99, wherein said first and said second gradient coils are arranged separate layers.

104. The system of claim 98, wherein said radiofrequency coil is positioned on a surface of said magnetic structure and further wherein said first gradient coil and said radiofrequency coil are arranged in one layer.

105. The system of claim 99, wherein said radiofrequency coil is positioned on a surface of said magnetic structure and further wherein said first gradient coil and said radiofrequency coil are arranged in one layer.

106. The system of claim 98, wherein said magnetic structure is detachable.

107. The system of claim 98, wherein said magnetic structure is replaceable.

108. The system of claim 98, wherein said magnetic structure comprises at least two parts, each independently operable to rotate about a longitudinal axis.

109. The system of claim 98, wherein said magnetic structure comprises at least two parts, each independently operable to move along a longitudinal axis.

110. The system of claim 83, wherein said plurality of domains comprises at least three domains.

111. The system of claim 83, wherein said plurality of domains comprises at least four domains.

112. The system of claim 83, wherein said predetermined geometry is selected from the group consisting of a cylinder, a disk, a prism, a sphere, a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.

113. The system of claim 83, wherein said predetermined geometry is elongated with respect to a longitudinal axis, and further wherein a size of said magnetic structure is selected so as to allow said magnetic structure to be inserted into

a body of a subject by endoscopy.

114. The system of claim 113, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed perpendicular to said longitudinal axis so that said monotonic static magnetic field is also in a direction perpendicular to said longitudinal axis.

115. The system of claim 113, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed parallel to said longitudinal axis so that said monotonic static magnetic field is also in a direction parallel to said longitudinal axis.

116. The system of claim 113, further comprising at least one additional magnetic structure designed connectable to said magnetic structure, wherein said at least one additional magnetic structure capable of generating a monotonic static magnetic field.

117. The system of claim 116, wherein said at least one additional magnetic structure operable to rotate about a transverse axis by one of a plurality of predetermined angles.

118. The system of claim 113, wherein said monotonic static magnetic field varies along said longitudinal axis.

119. The system of claim 113, wherein said magnetization vectors vary along a radial direction, said radial direction being perpendicular to said longitudinal axis.

120. The system of claim 113, wherein said magnetization vectors vary along an azimuthal direction, said azimuthal direction being perpendicular to said longitudinal axis.



121. The system of claim 83, said magnetic resonance probe further comprising at least one non-magnetic domain located so as to optimize a profile of said monotonic static magnetic field.

122. The system of claim 121, wherein said radiofrequency coil comprises a radiofrequency antenna and further wherein said at least one non-magnetic domain is constructed and designed for minimizing a load on said radiofrequency antenna and for minimizing magnetic acoustic ringing.

123. The system of claim 121, wherein a size of said at least one non-magnetic domain is selected so as to be surrounded by at least one radiofrequency coil.

124. The system of claim 121, wherein a size of said at least one non-magnetic domain is selected so as to minimize an amount of magnetic material present in said magnetic structure.

125. The system of claim 121, wherein said at least one radiofrequency coil comprises a soft magnetic material.

126. The system of claim 83, wherein said predetermined geometry is characterized by at least one substantially planar surface, said at least one substantially planar surface defined by an axis being perpendicularly to said at least one substantially planar surface.

127. The system of claim 126, wherein said plurality of domains are concentrically arranged about a center of said magnetic structure, and further wherein a magnetization vector of each domain has a component directed along said axis, so that said monotonic static magnetic field is also directed along said axis.

128. The system of claim 83, wherein said predetermined geometry is characterized by a planar surface and a non-planar surface, said non-planar surface having a first open end, adjacent to said planar surface, and a second open end, far from said planar surface, where an area of said first open end is smaller than an area of

said second open end.

129. The system of claim 128, wherein said plurality of domains are arranged within said non-planar surface, and further wherein a magnetization vector of each domain has a component directed substantially parallel to said planar surface, so that said monotonic static magnetic field is also directed substantially parallel to said planar surface.

130. The system of claim 83, wherein said predetermined geometry is a shell having a cavity and a symmetry axis, said shell is selected from the group consisting of a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.

131. The system of claim 130, wherein a magnetization vector of each domain is directed along said symmetry axis so that said monotonic static magnetic field is also directed along said symmetry axis.

132. The system of claim 130, wherein a magnetization vector of each domain is directed perpendicularly to said symmetry axis so that said monotonic static magnetic field is also directed perpendicularly to said symmetry axis.

133. The system of claim 83, further comprising at least one additional radiofrequency coil for generating a broad-band radiofrequency magnetic field and at least one additional magnetic structure for generating a monotonic static magnetic field having a gradient, wherein each of said at least one additional radiofrequency coil is in proximity to said at least one additional magnetic structure.

134. The system of claim 83, wherein the object is a mammal.

135. The system of claim 83, wherein the object is an organ of a mammal.

136. The system of claim 83, wherein the object is a tissue.
137. The system of claim 83, wherein the object is a swollen elastomer.
138. The system of claim 83, wherein the object is a food material.
139. The system of claim 83, wherein the object is liquid.
140. The system of claim 139, wherein said liquid is oil.
141. The system of claim 83, wherein the object is at least one type of molecules present in a solvent.
142. The system of claim 141, wherein said at least one type of molecules present in said solvent is selected from the group consisting of molecule dissolved in said solvent, a molecule dispersed in said solvent and a molecule emulsed in said solvent.
143. The system of claim 83, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating predetermined and different magnetic resonance responses in predetermined and different types of cells.
144. The system of claim 143, wherein said predetermined types of cells are selected from the group consisting of a part of a tumor, a part of a malignant tumor, a part of a blood vessel tissue, a part of a pathological tissue and a part of a restenotic tissue.
145. The system of claim 83, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating a predetermined and different magnetic resonance responses in a first substance and in

at least one additional substance present in or surrounded by said first substance, thereby distinguishing between said first substance and said at least one additional substance.

146. The system of claim 83, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating a magnetic resonance response in at least one substance having dynamical resonance characteristics, said dynamical resonance characteristics being time-dependent.

147. The system of claim 146, design and constructed to monitor said dynamical resonance characteristics.

148. A system for analyzing an object, the system comprising:  
a processing unit;  
a magnetic resonance probe; and  
a position tracking system for determining a position of said magnetic resonance probe;

wherein said magnetic resonance probe comprising a radiofrequency coil, designed and configured for generating a broad-band radiofrequency magnetic field, and a magnetic structure for generating a monotonic static magnetic field having a gradient, said magnetic structure comprising a plurality of domains, said plurality of domains being arranged within a volume having predetermined geometry, each of said plurality of domains being characterized by a predetermined and different magnetization vector, wherein said predetermined geometry and said plurality of domains are selected so as to generate said monotonic static magnetic field.

149. The system of claim 148, wherein said position tracking system is selected from the group consisting of an articulated arm position tracking system, an accelerometers based position tracking system, a potentiometers based position tracking system, a sound wave based position tracking system, a radio frequency based position tracking system, an AC based position tracking system, a magnetic field based position tracking system and an optical based position tracking system.

150. The system of claim 148, further comprising a first gradient coil for generating a magnetic field having a gradient substantially in a first transverse direction.

151. The system of claim 150, further comprising a second gradient coil for generating a magnetic field having a gradient substantially in a second transverse direction.

152. The system of claim 150, wherein said first gradient coil is positioned on a surface of said magnetic structure.

153. The system of claim 151, wherein said first and said second gradient coils are positioned on a surface of said magnetic structure.

154. The system of claim 151, wherein said first and said second gradient coils are arranged in one layer.

155. The system of claim 151, wherein said first and said second gradient coils are arranged separate layers.

156. The system of claim 150, wherein said radiofrequency coil is positioned on a surface of said magnetic structure and further wherein said first gradient coil and said radiofrequency coil are arranged in one layer.

157. The system of claim 151, wherein said radiofrequency coil is positioned on a surface of said magnetic structure and further wherein said first gradient coil and said radiofrequency coil are arranged in one layer.

158. The system of claim 150, wherein said magnetic structure is detachable.

159. The system of claim 150, wherein said magnetic structure is replaceable.

160. The system of claim 150, wherein said magnetic structure comprises at least two parts, each independently operable to rotate about a longitudinal axis.

161. The system of claim 150, wherein said magnetic structure comprises at least two parts, each independently operable to move along a longitudinal axis.

162. The system of claim 148, wherein said plurality of domains comprises at least three domains.

163. The system of claim 148, wherein said plurality of domains comprises at least four domains.

164. The system of claim 148, wherein said predetermined geometry is selected from the group consisting of a cylinder, a disk, a prism, a sphere, a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.

165. The system of claim 148, wherein said predetermined geometry is elongated with respect to a longitudinal axis.

166. The system of claim 165, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed perpendicular to said longitudinal axis so that said monotonic static magnetic field is also in a direction perpendicular to said longitudinal axis.

167. The system of claim 165, wherein said plurality of domains are arranged along said longitudinal axis, and further wherein a magnetization vector of each domain has a component directed parallel to said longitudinal axis so that said monotonic static magnetic field is also in a direction parallel to said longitudinal axis.

168. The system of claim 165, further comprising at least one additional magnetic structure designed connectable to said magnetic structure, wherein said at least one additional magnetic structure capable of generating a monotonic static magnetic field.

169. The system of claim 168, wherein said at least one additional magnetic structure operable to rotate about a transverse axis by one of a plurality of predetermined angles.

170. The system of claim 165, wherein said monotonic static magnetic field varies along said longitudinal axis.

171. The system of claim 165, wherein said magnetization vectors vary along a radial direction, said radial direction being perpendicular to said longitudinal axis.

172. The system of claim 165, wherein said magnetization vectors vary along an azimuthal direction, said azimuthal direction being perpendicular to said longitudinal axis.

173. The system of claim 148, further comprising at least one non-magnetic domain located so as to optimize a profile of said monotonic static magnetic field.

174. The system of claim 173, wherein said radiofrequency coil comprises a radiofrequency antenna and further wherein said at least one non-magnetic domain is constructed and designed for minimizing a load on said radiofrequency antenna and for minimizing magnetic acoustic ringing.

175. The system of claim 173, wherein a size of said at least one non-magnetic domain is selected so as to be surrounded by at least one radiofrequency coil.

176. The system of claim 173, wherein a size of said at least one non-magnetic domain is selected so as to minimize an amount of magnetic material present

in said magnetic structure.

177. The system of claim 173, wherein said at least one radiofrequency coil comprises a soft magnetic material.

178. The system of claim 148, wherein said predetermined geometry is characterized by at least one substantially planar surface, said at least one substantially planar surface defined by an axis being perpendicularly to said at least one substantially planar surface.

179. The system of claim 178, wherein said plurality of domains are concentrically arranged about a center of said magnetic structure, and further wherein a magnetization vector of each domain has a component directed along said axis, so that said monotonic static magnetic field is also directed along said axis.

180. The system of claim 148, wherein said predetermined geometry is characterized by a planar surface and a non-planar surface, said non-planar surface having a first open end, adjacent to said planar surface, and a second open end, far from said planar surface, where an area of said first open end is smaller than an area of said second open end.

181. The system of claim 180, wherein said plurality of domains are arranged within said non-planar surface, and further wherein a magnetization vector of each domain has a component directed substantially parallel to said planar surface, so that said monotonic static magnetic field is also directed substantially parallel to said planar surface.

182. The system of claim 148, wherein said predetermined geometry is a shell having a cavity and a symmetry axis, said shell is selected from the group consisting of a hemisphere, a portion of a sphere, an ellipsoid, a portion of ellipsoid, a hyperboloid, a portion of a hyperboloid, a paraboloid, a portion of a paraboloid, a cylindrical shell, a portion of a cylindrical shell, a polyhedron shell and a portion of a polyhedron shell.



183. The system of claim 182, wherein a magnetization vector of each domain is directed along said symmetry axis so that said monotonic static magnetic field is also directed along said symmetry axis.

184. The system of claim 182, wherein a magnetization vector of each domain is directed perpendicularly to said symmetry axis so that said monotonic static magnetic field is also directed perpendicularly to said symmetry axis.

185. The system of claim 148, further comprising at least one additional radiofrequency coil for generating a broad-band radiofrequency magnetic field and at least one additional magnetic structure for generating a monotonic static magnetic field having a gradient, wherein each of said at least one additional radiofrequency coil is in proximity to said at least one additional magnetic structure.

186. The system of claim 148, wherein the object is a mammal.

187. The system of claim 148, wherein the object is an organ of a mammal.

188. The system of claim 148, wherein the object is a tissue.

189. The system of claim 148, wherein the object is a swollen elastomer.

190. The system of claim 148, wherein the object is a food material.

191. The system of claim 148, wherein the object is liquid.

192. The system of claim 191, wherein said liquid is oil.

193. The system of claim 148, wherein the object is at least one type of molecules present in a solvent.

194. The system of claim 193, wherein said at least one type of molecules

present in said solvent is selected from the group consisting of molecule dissolved in said solvent, a molecule dispersed in said solvent and a molecule emulsed in said solvent.

195. The system of claim 148, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating predetermined and different magnetic resonance responses in predetermined and different types of cells.

196. The system of claim 195, wherein said predetermined types of cells are selected from the group consisting of a part of a tumor, a part of a malignant tumor, a part of a blood vessel tissue, a part of a pathological tissue and a part of a restenotic tissue.

197. The system of claim 148, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating a predetermined and different magnetic resonance responses in a first substance and in at least one additional substance present in or surrounded by said first substance, thereby distinguishing between said first substance and said at least one additional substance.

198. The system of claim 148, wherein said magnetic structure and said radiofrequency coil are designed and constructed so that said monotonic static magnetic field and said radiofrequency magnetic field are capable of generating a magnetic resonance response in at least one substance having dynamical resonance characteristics, said dynamical resonance characteristics being time-dependent.

199. The system of claim 198, design and constructed to monitor said dynamical resonance characteristics.